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To whom it may concern:

Like many, I have been watching, with interest, the large amount of effort being directed towards the Chesapeake Bay Watershed cleanup efforts, in particular, the efforts of the state of Pennsylvania. Recently, I had the opportunity to read the Summary EPA Evaluation of the Phase I Pennsylvania Draft Watershed Implementation Plan (WIP). While the progress made to date has been significant, the challenges which this Evaluation noted will continue to require commitment, diligence and execution of a well designed comprehensive strategy by the Pennsylvania Department of Environmental Protection. I would like to share with you progress which the company I represent, Algae Producers of America (APA) and its partner organizations, has achieved in realizing the level of nutrients reduction which are required. Before sharing the results of our efforts, it is important to share a little bit about APA.

APA is an Ohio based company located in the greater Cleveland area. Our goal is to provide algal based solutions to current and emerging market needs. To accomplish this, we have established an Open Innovation Technology Platform consisting of member organizations from universities, industry and commercial users. Of our partner organizations, approximately 39% are actively involved in some form of bio-remediation effort. Additionally, APA is the lead commercial partner for a recent State of Ohio Third Frontier Grant awarded to Ohio University (OTF 10-510, titled *Center for Algal Engineering Research and Commercialization*). The purpose of this Third Frontier Grant is to establish a Center of Excellence for the development and commercialization of algae-based technologies, with an emphasis on use of waste nutrients. In addition to Ohio University and APA, this effort involves 10 additional partners, including several major Fortune 500 international companies.

We recently submitted comments to the Ohio EPA in response to a request for assistance from industry on available technologies which might be usable to the State of Ohio in addressing several excessive nutrient-related issues which the state faced this past summer. It occurred to me that these same technologies may be usable to you in your efforts. The following comments are offered for consideration and review for inclusion as part of the overall comprehensive strategy you have undertaken:

- The potential use of algae-based technologies to reduce nutrient loads is a recognized technology. The US Department of Energy *Aquatic Species Program* identified this technology as a viable use of the nutrients inherently present in wastewater treatment facilities. While there are several companies who claim to be able to reduce nutrient loads through the use of algae-based systems, very little is known about their effectiveness. We have demonstrated the ability to significantly reduce nutrient loads at multiple sites. The data summarized below is a compilation of results obtained from four separate sites located across multiple northern and northwestern states and includes both wastewater treatment facilities (up to 8M GPD capacity) and industrial facilities:

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Constituent reduced	Range of reduction achieved	Typical post treatment result
Total Phosphorus	75 - 99%	<0.03 mg/L
Total Nitrogen	71%	<0.20 mg/L
BOD	59% - 76%	<3 kg/ton
TSS	95%	-
pH	6%	-
Color	42%	-
PCB	Not detectable	-

- In addition to the above data, the following third party analysis data was recently obtained from one of our recent demonstration sites (a 3.5M GPD wastewater treatment facility) on multiple effluent streams:

Nutrient	Stream	Result, mg/L	
		Pre Treatment	Post Treatment
Phosphorus	1	0.570	0.023
Phosphorus	2	0.806	0.028
Phosphorus	3	0.816	0.024
Phosphorus	4	0.638	0.034
BOD	5	2.6	Not Detectable
BOD	6	-	Not Detectable

- The above results clearly demonstrate the ability to exceed current capabilities of Enhanced Nutrient Reduction (ENR) technology. Our technology offers several distinct advantages:
 - Our solution is based on the incorporation of a "bolt-on" closed system. This system uses treatment modules that can be sized to the individual need. This allows for a much smaller footprint than conventional "open pond" designs. For example, a two acre site based on our solution could treat up to 10M GPD.
 - Being a bolt-on design, no significant change to an existing infrastructure is necessary. Our solution will accept incoming effluent from either a primary or secondary treatment stage and the resulting post-treated effluent can either be directly discharged or be further processed for chlorination if desired.
 - The above two items are significant in that individual treatment modules can be developed for application at multiple point sources. Further, the results above have been demonstrated in year-round conditions and are not restricted to warmer month operation.
- One of the challenges the State of Ohio faced this past summer was the occurrence of multiple algae-blooms at different locations across the state at the same time. As part of our efforts, we use a mobile demonstration module that

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may be transported to a potential site and quickly set-up for a period of time (typically 30-45 days) to verify that an algae-based solution is viable. This proof of concept approach helps to mitigate the risks associated with adoption of this technology and helps to further quantify the potential benefits so that a more informed decision can be made.

- In addition to reducing nutrients, the use of an algae-based solution to reducing nutrient loads at point sources (such as wastewater treatment facilities or industrial / Concentrated Agricultural Feed Operations [CAFO] sites) also brings several additional benefits, including:
 - The ability to produce valuable co-products based on algae biomass (Note: This is a key area of focus for OTF 10-510). The Pennsylvania WIP includes a Nutrient Credit Trading Program. The first auction held on October 28 and 29 resulted in the exchange of 21,000 credits (Susquehanna nitrogen) at a price of \$3.04/credit. Adoption of a proven algae-based solution not only results in additional potential revenue from the production of valuable co-products, but also allows for additional potential revenue which could be realized through participation in this aspect of the WIP.
 - The ability to reduce Greenhouse Gas (GHG) Emissions (controlled algae growth will use approximately 1.5 - 1.8 tonnes of CO₂ for each tonne of algae produced, plus release approximately 1.5 tonnes of oxygen in the process). As you may be aware, the process of nitrification and denitrification common as part of a Biological Nutrition Reduction (BNR), can actually increase GHG emissions through the process of release of N₂O (the Center for Sustainable Systems estimated that in 2006, 0.5% of all GHG emissions were related to wastewater treatment operations).
- Reviewing the EPA Evaluation of the Pennsylvania Draft Watershed Implementation Plan, it was noted a rating of "**Serious Deficiencies**" was assigned due to P (11%) and TSS (1%) being over the 7/1 and 8/13 allocations. As a result, a High Level backstop allocation for Pennsylvania point sources is possible unless the Phase I WIP is strengthened. This could result in significant additional costs if the limit of technology (3mg/L TN and 0.1mg/L TP) for Waste Water Treatment Plants is required. Further, the limit of technology levels identified are representative of Biological Nutrient Reduction (BNR) technologies. There is a growing movement towards Enhanced Nutrient Reduction (ENR) technologies and it is quite possible that these more stringent requirements could be mandated. As summarized in the earlier tables, we have consistently demonstrated the ability to exceed even the more stringent ENR targets at multiple sites.

Finally, in reviewing the relevant remediation technologies, the Ohio EPA considers the following 5 areas of concern for each suggested technology proposed:

- *Does the technology specifically address the cause of water quality impairments?*
 - Our technology should be considered as part of a comprehensive technology roadmap to address the challenges faced. We have

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demonstrated the ability to successfully address the reduction of nutrient loads from point sources, such as wastewater treatment facilities and industrial sites to levels below those commonly achieved through ENR technologies. The result is reduced nutrient inflow into targeted waterways.

- *Is the technology cost-effective?*
 - Our technology is a bolt-on module which does not require significant changes to infrastructure. Further, the smaller foot-print required also reduces the valuable land space required. Our mobile demonstration module provides proof of concept before any monies would be expended on a more "permanent" solution, thereby enabling a more informed decision to be made.
- *Is the proposed technology sustainable?*
 - The use of an algae-based solution as part of a comprehensive strategy is sustainable and environmentally beneficial through its reduction in GHG emissions and production of valuable co-products. Further, we have demonstrated the ability to reduce nutrient loads on a year round basis.
- *Has the technology been peer-reviewed or is it experimental in nature?*
 - The State of Ohio through its awarding of an Ohio Third Frontier Grant has acknowledged that algae-based solutions are viable possibilities. Our customers who are currently using this technology would support that it does work.
- *Does the technology have a track record dealing with problems on the scale needed?*
 - Like other significant bio-remediation challenges, the solution to the problems faced will require a comprehensive approach involving technical solutions, land management, and education. Our technology would be considered a part of this effort. In demonstration at several municipal wastewater treatment facilities (up to 8M GPD capacity), we believe our track record is established.

On behalf of APA and our partner organizations, I want to thank you for the opportunity to provide input for your further review and consideration. I would be pleased to provide additional information to whoever may be interested on how this technology could possibly be incorporated into your overall plan. I can also arrange for direct conversations with municipal and industrial users of our technology who can attest to its performance.

We look forward to working closer with you in the future.

Regards,

Rick Johnson
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Algae Producers of America